

March 14, 2012



Office of Electricity Delivery & Energy Reliability



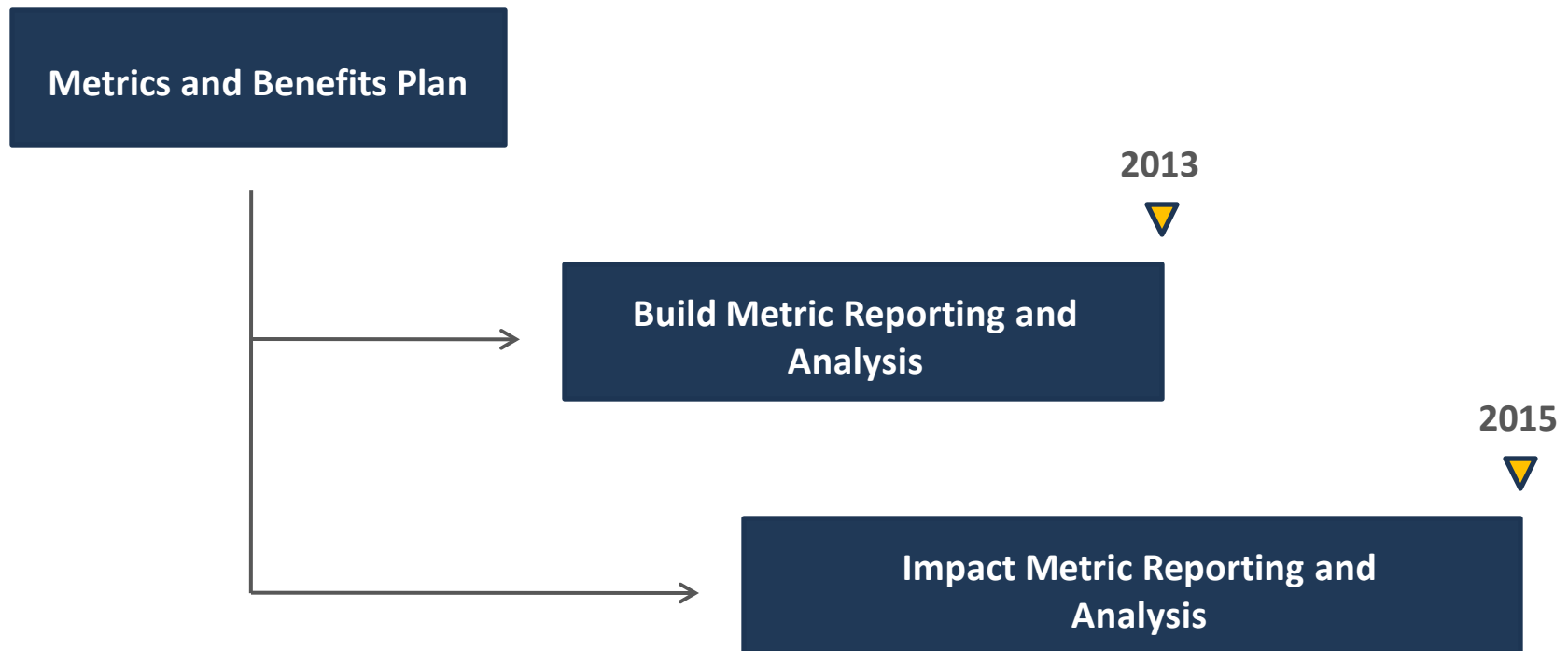
Operations and Maintenance (O&M) Savings from Advanced Metering

DOE Analysis Approach



Introduction

Build and impact metric data provided by the SGIG recipients convey the type and extent of technology deployment, as well as its effect on grid operation and system efficiency.





Six Primary Analysis Focus Areas

There are six areas where the analysis is focused. This presentation addresses analysis efforts associated with O&M savings from Advanced Metering Infrastructure (AMI).

Peak Demand and Electricity Consumption

- Advanced Metering Infrastructure
- Pricing Programs and Customer Devices
- Direct Load Control

Operations and Maintenance Savings from Advanced Metering

- Meter Reading
- Service changes
- Outage management

Distribution System Reliability

- Feeder switching
- Monitoring and health sensors

Energy Efficiency in Distribution Systems

- Voltage optimization
- Conservation voltage reduction
- Line losses

Operations and Maintenance Savings from Distribution Automation

- Automated and remote operations
- Operational Efficiency

Transmission System Operations and Reliability

- Application of synchrophasor technology for wide area monitoring, visualization and control



DOE/Recipient Dialogue

DOE would like to establish a dialogue with recipients to explore O&M savings from AMI using remote connect/disconnect, outage notification and power quality monitoring. The outcome is to share this information across the industry.

DOE's Interests	Recipients' Interests
<ol style="list-style-type: none">1. Analysis Approach: Working through issues relating to measuring impacts<ol style="list-style-type: none">a. Analytical methodologyb. Baseline/Underlying factors leading to resultsc. How to convey the results and to whom?2. Lessons-Learned/Best-Practices: Internally and externally conveyed<ol style="list-style-type: none">a. What can we learn from each other?b. How do we want to document lessons-learned and best practices for external communication?c. Are there detailed case studies that can be developed?	<ol style="list-style-type: none">1. What would you like to address in a group setting?2. What do you want to learn or share?3. How would you like to exchange information?<ol style="list-style-type: none">a. In smaller or more focused groups?b. How should we structure and support the discussion?4. Are there issues you are NOT interested in addressing here?



DOE's Analysis Objectives

This focus area will examine O&M savings from AMI, be exploring AMI system functionality through utilization of remote connect/disconnect, power quality monitoring and outage identification.

Analysis Objectives

- Determine the amount of operations (O&M) savings achieved by AMI projects.
- Determine what technology configurations and smart meter features are most important for delivering measurable results.
- Quantify the operations savings from AMI.

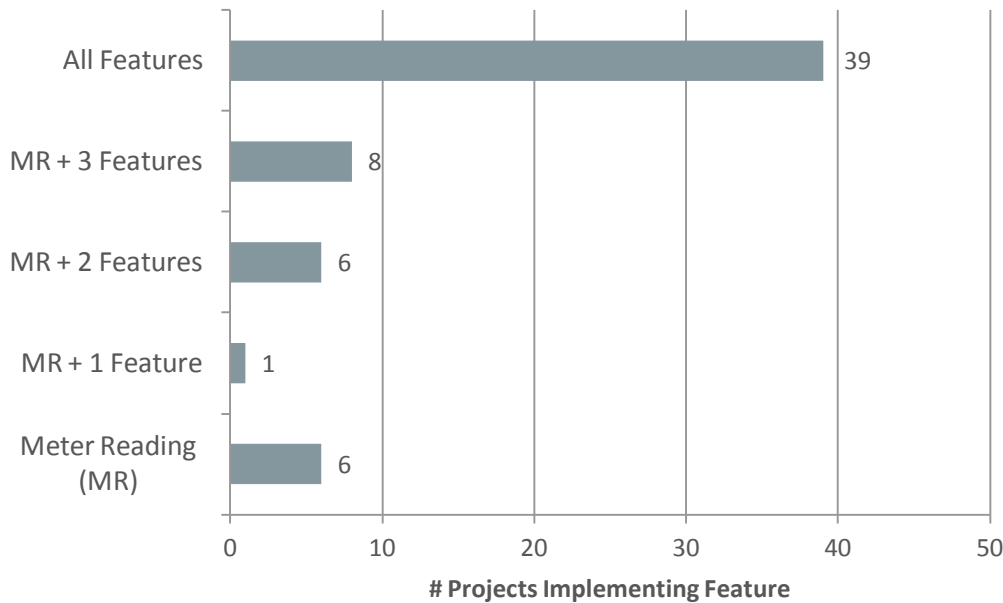


SGIG Projects

SGIG projects are implementing different technology configurations to reduce meter operations costs.

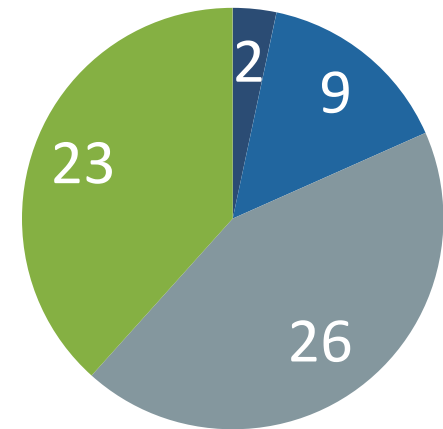
60 SGIG Projects are Implementing AMI Smart Meters with varying levels of functionality

Distribution of Smart Meter Feature Combinations



A feature represents one of the following: Voltage and Power Monitoring, Outage Detection and Notification, Tamper Detection, and Remote Service Switch.

60 SGIG Projects are Integrating their AMI systems into other systems



- Integration - 1 system
- Integration - 2 systems
- Integration - 3 systems
- Integration - 4 systems

A system represents one of the following: Billing, Customer Information, Outage Management, or Distribution MS.

Source: SGIG Build metrics and Navigant analysis



AMI Technologies

SGIG project teams are deploying a variety of different technologies.

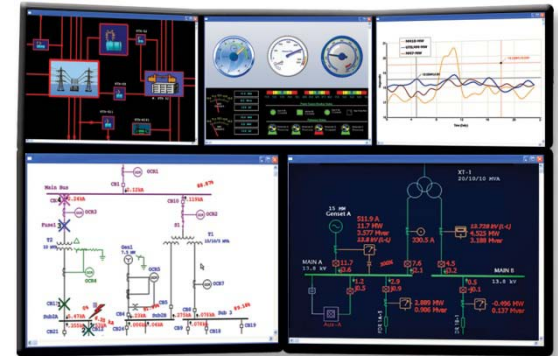
AMI Smart Meter



Meter Data Management System



Utility Systems



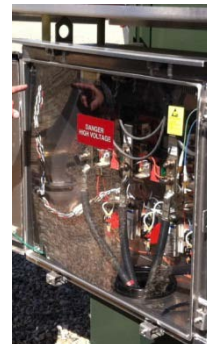
Communications Infrastructure



RF Access Point for backhaul



Wireless modem for backhaul communications



Power Line Carrier



Collector with phone line backhaul



Applications for AMI

DOE has also observed projects that are using a combination of monitoring equipment, remote equipment control and condition notification to reduce O&M costs.

Remote Equipment Monitoring and Data Acquisition

Utilizing two-way communications and AMI smart meters to remotely monitor load conditions, change meter set points, and acquire customer electricity usage data from nodes.

Remote Equipment Control

Utilizing two-way communications and remote service switch to initiate or terminate service.

Condition Notification

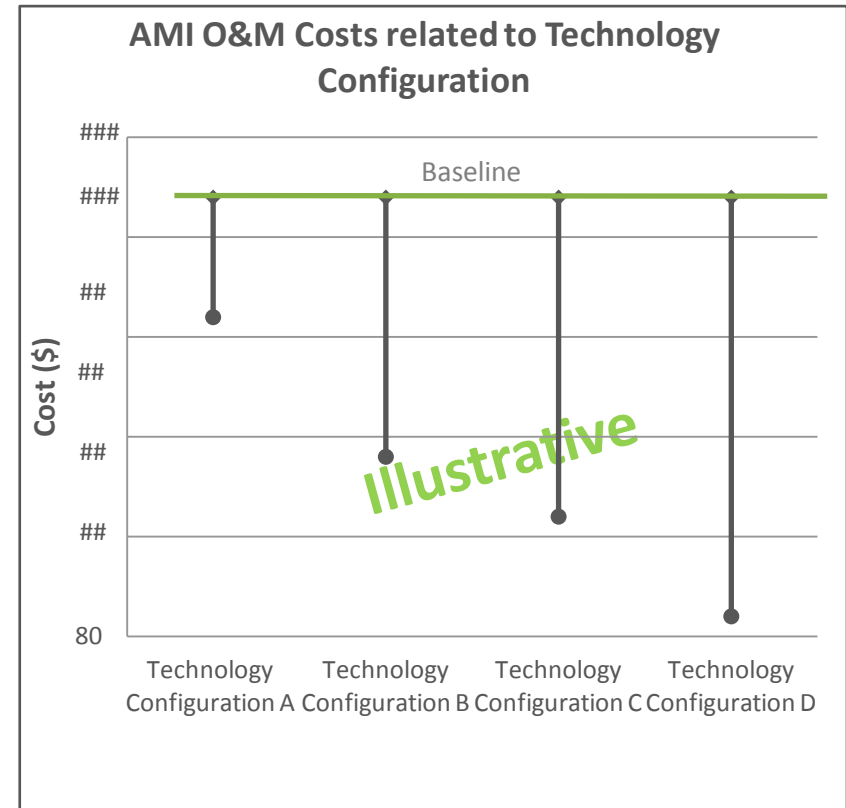
Utilizing two-way communications and utility systems to identify meter tampering, outages, and power quality issues.



Functionality and Impact Hypothesis

Our hypothesis is that relative benefits will increase with higher functionality from remote connect/disconnect, outage reporting and tamper detection

Group	AMI Smart Meter Functionality
A	<ul style="list-style-type: none">• AMI (meter reading)
B	<ul style="list-style-type: none">• AMI with remote connect/disconnect integrated with MDMS or CIS
C	<ul style="list-style-type: none">• AMI with remote connect/disconnect and outage reporting integrated with OMS
D	<ul style="list-style-type: none">• AMI with remote connect/disconnect, power quality monitoring, outage reporting integrated with OMS and tamper detection integrated with CIS





Build and Impact Metrics

Build and Impact metrics will track the deployment of technology and how it affects operational efficiency.

Key Build Metrics (Technologies)

- Number of meter end points
- Smart Meter features
 - Outage reporting
 - Power quality
 - Remote Connect/Disconnect
 - Tamper Detection
- Two-way communications infrastructure
- Integrated systems
 - Billing system
 - Head end system (HES)
 - Outage Management System (OMS)
 - Customer Information System (CIS)
 - Meter Data Management Systems (MDM)

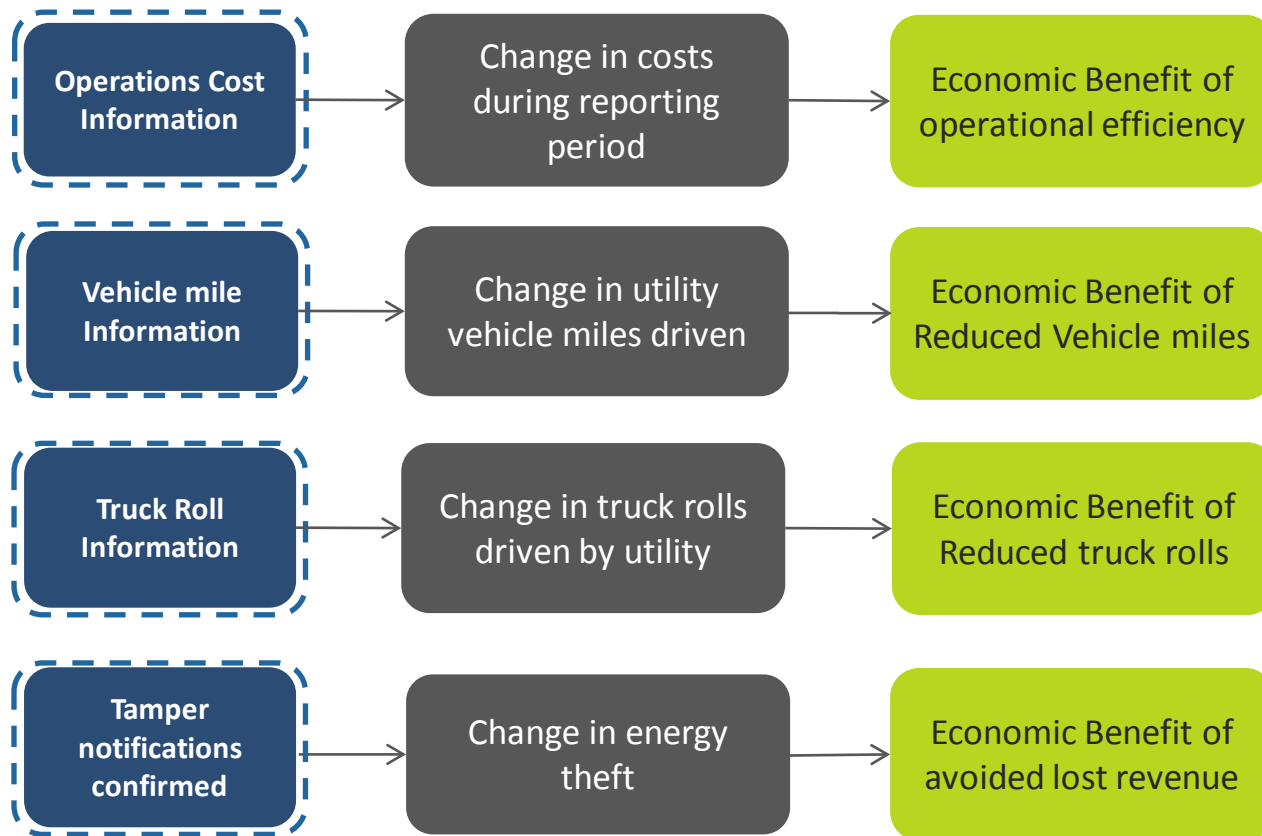
Key Impact Metrics

- Meter Operations Costs
- Meter Vehicle Miles
- Avoided Truck Rolls
- Number of Tamper Detections
- Tamper detections confirmed
- Vehicle CO2 Emissions
- Vehicle Pollutant Emissions



Logic for Analyzing AMI O&M Savings

DOE will analyze O&M costs and other impact metrics to calculate the economic benefits of smart grid technologies.



Legend

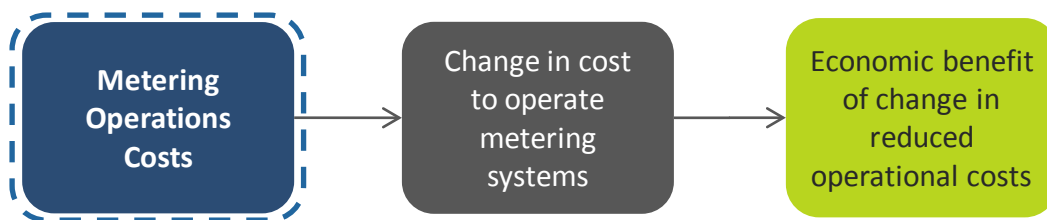
- Impact metric
- Change in Impact
- Analysis
- Benefit



AMI O&M Costs

DOE will analyze changes in AMI operations costs to calculate utility operational benefits.

- These results will be accounted for and aggregated in the AMI Operations and Maintenance Focus Area.



Value (\$) = [Number of Meter Reading Operations (# of events) * Average Cost per Meter Reading Operation (\$/event)]_{Baseline} - [Number of Meter Reading Operations (# of events) * Average Cost per Meter Reading Operation (\$/event)]_{Project}

Legend



Impact metric



Change in Impact



Analysis Objectives



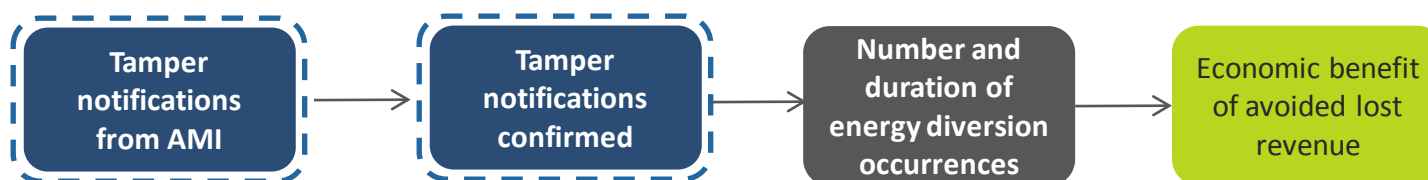
Benefit Calculation



Value of Tamper Notifications

Meter tampering and energy diversion results in lost revenue for the utility. This metric will be analyzed separately due to different accounting treatment by regulators.

- Some utilities are allowed to socialize all or a portion lost revenue across ‘paying’ customers while other utilities are required to treat lost revenue as an operating expense
- The tamper notification smart meter feature and more frequent and granular usage information enables utilities to identify tampering and reduce the amount of energy diversion.



Legend



Impact metric

Change in Impact



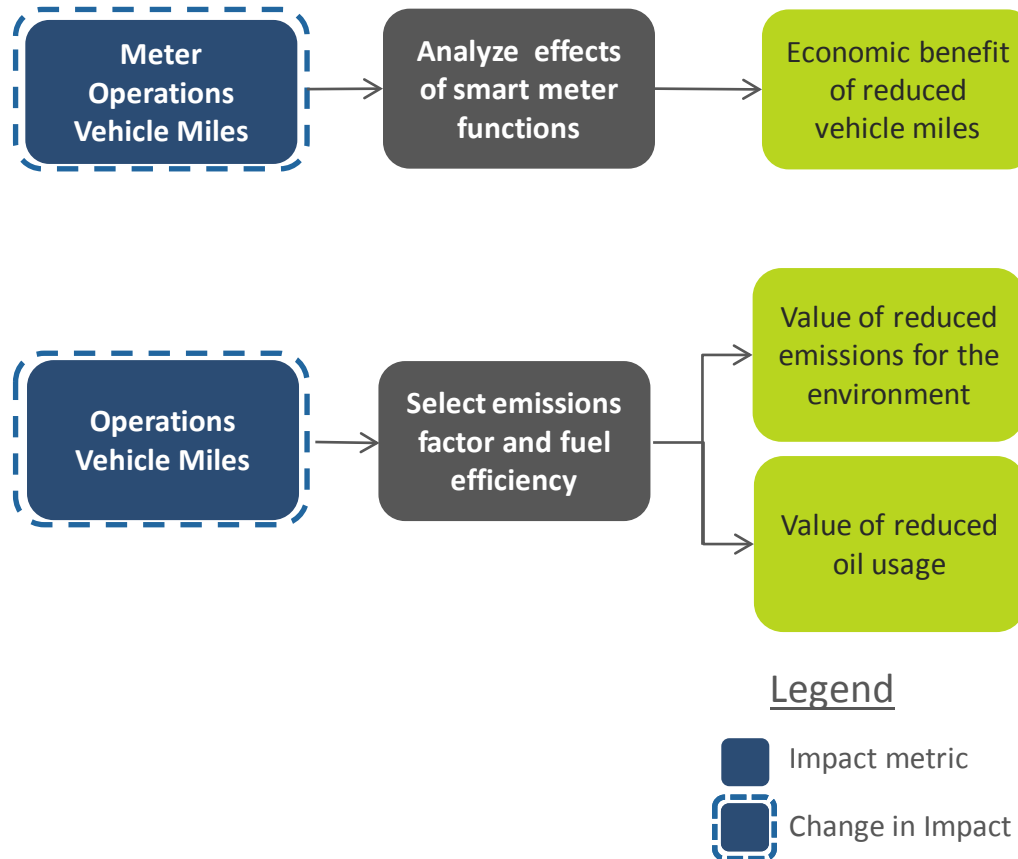
Analysis

Benefit



Value of reduced vehicle miles

DOE will analyze the effect of different technology configurations that can contribute to determining the change in vehicle emissions.





Additional Analytical Questions

- What other kinds of impacts are project teams expecting, and how should we be looking for them in the metrics data?
- What other kinds of data or information can be shared to help the group understand impact?
- How are utilities operating AML equipment and leveraging data, and how can that shared?
- How are baseline and avoided costs being established?